



# CMS460-D



**Load current evaluators for 12 measuring channels**  
for monitoring AC currents up to 125 A  
Software Version: D233 V2.42 / D256 V2.29



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## Table of Contents

<b>1. Important information</b>	<b>7</b>
1.1 How to use this manual	7
1.2 Technical support: service and support	8
1.2.1 First level support	8
1.2.2 Repair service	8
1.2.3 Field service	9
1.3 Training courses	10
1.4 Delivery conditions	10
1.5 Inspection, transport and storage	10
1.6 Warranty and liability	11
1.7 Disposal	12
<b>2. Safety instructions</b>	<b>13</b>
2.1 General safety instructions	13
2.2 Work activities on electrical installations	13
2.3 Intended use	14
<b>3. System description</b>	<b>15</b>
3.1 Typical applications	15
3.2 Description of function	15
<b>4. Installation and connection</b>	<b>19</b>
4.1 IFuses, max. voltage, cable lengths	19
4.2 Installation instructions	20
4.3 Connection	20
4.3.1 Dimension diagram	20
4.3.2 Wiring diagram	21
4.3.3 Connection of W..., WR..., WS... series measuring current transformers	23

4.3.4	Connection WF... series measuring current transformers .....	24
4.3.5	Connection example CMS460 system with FTC470XET .....	25
<b>5.</b>	<b>Commissioning .....</b>	<b>29</b>
5.1	Before switching on .....	29
5.2	Switching on .....	30
<b>6.</b>	<b>Operation .....</b>	<b>31</b>
6.1	Operator control and display elements .....	31
6.2	Working in operating mode .....	32
6.2.1	Standard display .....	32
6.2.2	Alarm causes .....	32
6.2.3	Test procedure .....	34
6.2.4	Resetting saved alarm messages (RESET) .....	35
6.2.5	Displaying standard information .....	36
6.3	Operation and setting .....	36
6.3.1	Opening the main menu .....	36
6.3.2	Menu overview diagram .....	38
6.3.3	Main menu functions .....	39
6.4	The main menu .....	40
6.4.1	Menu 1: Alarm/meas.values .....	40
6.4.2	Menu 2: % Bar graph .....	41
6.4.3	Menu 3: History .....	41
6.4.4	Menu 4: Harmonics .....	43
6.4.5	Menu 5: Data logger .....	45
6.4.6	Menu 6: Settings .....	46
6.4.6.1	Settings menu 1: General .....	47
6.4.6.2	Settings menu 2: PRESET .....	48
6.4.6.3	Settings menu 3: Channel .....	50
6.4.6.4	Settings menu 4: Relays .....	56
6.4.6.5	Settings menu 5: History .....	57
6.4.6.6	Settings menu 6: Data logger .....	57
6.4.6.7	Settings menu 7: Language .....	59

6.4.6.8	Settings menu 8: Interface .....	59
6.4.6.9	Settings menu 9: Alarm addresses .....	59
6.4.6.10	Settings menu 10: Clock .....	60
6.4.6.11	Settings menu 11: Password .....	60
6.4.6.12	Settings menu 12: Factory settings .....	61
6.4.6.13	Settings menu 13: Service .....	61
6.4.7	Menu 7: Control .....	62
6.4.7.1	Control menu 1: TEST .....	62
6.4.7.2	Control menu 2: RESET .....	62
6.4.7.3	Control menu 3: Test communication .....	62
6.4.8	Menu 8: External devices .....	64
6.4.9	Menu 9: Info .....	65
<b>7.</b>	<b>Tests, service, troubleshooting .....</b>	<b>67</b>
7.1	Periodic verification .....	67
7.2	Maintenance and service .....	67
7.3	Troubleshooting .....	67
7.3.1	Device error display .....	67
7.3.2	Device error display (channel-related) .....	69
7.3.3	External alarm .....	69
<b>8.</b>	<b>Data .....</b>	<b>71</b>
8.1	Technical data .....	71
8.2	Standards, approvals, certifications .....	76
8.3	Ordering information .....	76
<b>INDEX</b>	<b>.....</b>	<b>83</b>



# 1. Important information

## 1.1 How to use this manual



This manual is intended for **qualified personnel** working in electrical engineering and electronics!

### Always keep this manual within easy reach for future reference.

To make it easier for you to understand and revisit certain sections in this manual, we have used symbols to identify important instructions and information. The meaning of these symbols is explained below:



This signal word indicates that there is a **high risk of danger** that will result in **electrocution** or **serious injury** if not avoided.



This signal word indicates a **medium risk of danger** that can lead to **death** or **serious injury** if not avoided.



This signal word indicates a **low level risk** that can result in **minor** or **moderate injury or damage to property** if not avoided.



This symbol denotes information intended to assist the user in making **optimum use** of the product.

This manual has been compiled with great care. It might nevertheless contain errors and mistakes. Bender cannot accept any liability for injury to persons or damage to property resulting from errors or mistakes in this manual.

## 1.2 Technical support: service and support

For commissioning and troubleshooting Bender offers you:

### 1.2.1 First level support

Technical support by phone or e-mail for all Bender products

- Questions concerning specific customer applications
- Commissioning
- Troubleshooting

**Telephone:** +49 6401 807-760\*  
**Fax:** +49 6401 807-259  
In Germany only: 0700BenderHelp (Tel. and Fax)  
**E-mail:** support@bender-service.de

### 1.2.2 Repair service

Repair, calibration, update and replacement service for Bender products

- Repairing, calibrating, testing and analysing Bender products
- Hardware and software update for Bender devices
- Delivery of replacement devices in the event of faulty or incorrectly delivered Bender devices
- Extended guarantee for Bender devices, which includes an in-house repair service or replacement devices at no extra cost

**Telephone:** +49 6401 807-780\*\* (technical issues)  
**Fax:** +49 6401 807-784\*\*, -785\*\* (sales)  
**E-mail:** +49 6401 807-789  
repair@bender-service.de

Please send the devices for **repair** to the following address:



Bender GmbH, Repair-Service,  
Londorfer Str. 65,  
35305 Gruenberg

### 1.2.3 Field service

On-site service for all Bender products

- Commissioning, configuring, maintenance, troubleshooting of Bender products
- Analysis of the electrical installation in the building (power quality test, EMC test, thermography)
- Training courses for customers

**Telephone:** +49 6401 807-752\*\*, -762 \*\*(technical issues)  
+49 6401 807-753\*\* (sales)  
**Fax:** +49 6401 807-759  
**E-mail:** [fieldservice@bender-service.de](mailto:fieldservice@bender-service.de)  
**Internet:** [www.bender-de.com](http://www.bender-de.com)

\*Available from 7.00 a.m. to 8.00 p.m. 365 days a year (CET/UTC+1)

\*\*Mo-Thu 7.00 a.m. - 8.00 p.m., Fr 7.00 a.m. - 13.00 p.m

### **1.3 Training courses**

Bender is happy to provide training regarding the use of test equipment. The dates of training courses and workshops can be found on the Internet at [www.bender-de.com](http://www.bender-de.com) -> Know-how -> Seminars.

### **1.4 Delivery conditions**

Bender sale and delivery conditions apply.

For software products the "Softwareklausel zur Überlassung von Standard-Software als Teil von Lieferungen, Ergänzung und Änderung der Allgemeinen Lieferbedingungen für Erzeugnisse und Leistungen der Elektroindustrie" (software clause in respect of the licensing of standard software as part of deliveries, modifications and changes to general delivery conditions for products and services in the electrical industry) set out by the ZVEI (Zentralverband Elektrotechnik- und Elektronikindustrie e. V.) (German Electrical and Electronic Manufacturer's Association) also applies.

Sale and delivery conditions can be obtained from Bender in printed or electronic format.

### **1.5 Inspection, transport and storage**

Inspect the dispatch and equipment packaging for damage, and compare the contents of the package with the delivery documents. In the event of damage in transit, please contact Bender immediately.

The devices must only be stored in areas where they are protected from dust, damp, and spray and dripping water, and in which the specified storage temperatures can be ensured.

## 1.6 Warranty and liability

Warranty and liability claims in the event of injury to persons or damage to property are excluded if they can be attributed to one or more of the following causes:

- Improper use of the device.
- Incorrect mounting, commissioning, operation and maintenance of the device.
- Failure to observe the instructions in this operating manual regarding transport, commissioning, operation and maintenance of the device.
- Unauthorised changes to the device made by parties other than the manufacturer.
- Non-observance of technical data.
- Repairs carried out incorrectly and the use of replacement parts or accessories not approved by the manufacturer.
- Catastrophes caused by external influences and force majeure.
- Mounting and installation with device combinations not recommended by the manufacturer.

This operating manual, especially the safety instructions, must be observed by all personnel working on the device. Furthermore, the rules and regulations that apply for accident prevention at the place of use must be observed.

## 1.7 Disposal

Abide by the national regulations and laws governing the disposal of this device. Ask your supplier if you are not sure how to dispose of the old equipment.

The directive on waste electrical and electronic equipment (WEEE directive) and the directive on the restriction of certain hazardous substances in electrical and electronic equipment (RoHS directive) apply in the European Community. In Germany, these policies are implemented through the "Electrical and Electronic Equipment Act" (ElektroG). According to this, the following applies:

- Electrical and electronic equipment are not part of household waste.
- Batteries and accumulators are not part of household waste and must be disposed of in accordance with the regulations.
- Old electrical and electronic equipment from users other than private households which was introduced to the market after 13 August 2005 must be taken back by the manufacturer and disposed of properly.

For more information on the disposal of Bender devices, refer to our homepage at [www.bender-de.com](http://www.bender-de.com) -> Service & support.

## 2. Safety instructions

### 2.1 General safety instructions

Part of the device documentation in addition to this manual is the enclosed "Safety instructions for Bender products".

### 2.2 Work activities on electrical installations



Only **qualified personnel** are permitted to carry out the work necessary to install, commission and run a device or system.



**DANGER**

#### **Risk of electrocution due to electric shock!**

Touching live parts of the system carries the risk of:

- An electric shock
- Damage to the electrical installation
- Destruction of the device

**Before installing and connecting the device, make sure that the installation has been *de-energised*.** Observe the rules for working on electrical installations.

If the device is used outside the Federal Republic of Germany, the applicable local standards and regulations must be complied with. The European standard EN 50110 can be used as a guide.

## 2.3 Intended use

The CMS460-D load current evaluator is designed for the localisation of load currents up to 125 A in TT, TN and IT systems, AC 42...2000 Hz (measuring range see "chapter 8.1 Technical data", paragraph "Measuring circuit").

The CMS system consists of one or several CMS460-D load current evaluators which are able to detect and evaluate load currents in earthed and unearthed power supplies via the associated measuring current transformers. The maximum voltage of the system to be monitored depends either on the nominal insulation voltage of the measuring current transformer on busbar systems, or the cables or conductors that are routed through.

For alternating and pulsating currents W... (closed), WR... (rectangular), WS... (split-core) and WF... (flexible) are used. Any combination of the various measuring current transformer series can be connected to the evaluator measuring channels. Each CMS460-D utilises 12 measuring channels. Up to 90 residual current monitors can be connected via a BMS bus (RS-485 interface with BMS protocol), thereby up to 1080 measuring channels (sub-circuits) can be monitored.

If this product is used for personnel protection, fire or plant protection, the frequency response can be set accordingly. The measured currents can be analysed for harmonics. The THF can also be determined (THF = **T**otal **H**armonic **F**actor).

In order to meet the requirements of the applicable standards, customised parameter settings must be made on the equipment in order to adapt it to local equipment and operating conditions. Please heed the limits of the range of application indicated in the technical data.

Any use other than that described in this manual is regarded as improper.

## 3. System description

In buildings and industrial installations, a fault or failure of the power supply involves high costs. In installations which require a high fault tolerance and good safety, an CMS460 system should constantly monitor the power supply for undercurrent and overcurrent. In addition, the CMS460-D can carry out an harmonics analysis for each channel.

### 3.1 Typical applications

- Monitoring loads and installations for load currents in the frequency range of 42...2000 Hz (measuring current transformers W..., WR..., WS..., WF..., measuring range see "chapter 8.1 Technical data")
- Monitoring of extremely dangerous currents in fire hazardous areas.
- EMC monitoring of TN-S systems for "stray currents" and additional N-PE connections.
- Monitoring of N conductors for overload caused by harmonics
- Monitoring of PE and equipotential bonding conductors to ensure there is no current flow.

### 3.2 Description of function

The currents are detected and evaluated as true r.m.s. values in the frequency range of 42...2000 Hz. All channels are scanned simultaneously so that the maximum scanning time for all channels is  $\leq 180$  ms if 1 x the response value is exceeded and  $\leq 30$  ms if 5 x the response value is exceeded .

The latest current values of all channels are shown on the LC display in bar graph format. If one of the two set response values is exceeded, the response delay  $t_{on}$  begins. Once the response delay has elapsed, the common alarm relays "K1/K2" switch and the alarm LEDs 1/2 light up.




Two response values/common alarm relays, which can be set separately, allow a distinction to be made between prewarning and alarm. The faulty channel(s) and the associated measured value are indicated on the LC display. If the current falls below or exceeds the release value (response value plus hysteresis), the release delay  $t_{\text{off}}$  begins. When the release delay has elapsed, the common alarm relays switch back to their initial state.

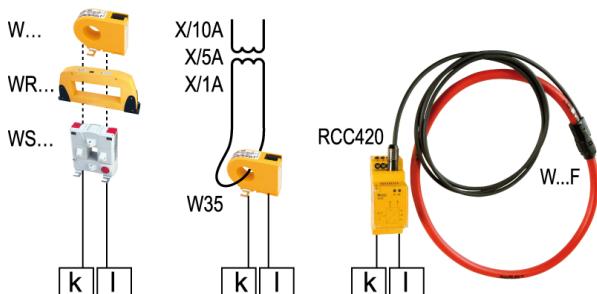
If the fault memory is enabled, the common alarm relays remain in the alarm state until the reset button is pressed or a reset command is sent via the BMS bus. The device function can be tested using the test button. Parameters are assigned to the device via the LC display and the control buttons on the front of one of the connected CMS460-D or via connected panels and protocol converters (e.g. FTC470XET). With the adjustable preset function the response values can be set for all channels taking the latest measured value for each channel into account.

Detailed information about all devices connected to the bus is displayed on the backlit graphical display of the CMS460-D. Parameters can be assigned to all devices connected to the BMS bus (e.g. RCMS460-D/-L, RCMS490-D/-L, CMS460-D) and all measurement details can be displayed. Several CMS460-D devices can be used within one system.



## Connecting measuring current transformers

$I_L, I_N, I_{PEN-PE}$	$I_L, I_N, I_{PEN-PE}$	$I_L, I_N, I_{PEN-PE}$
42...2000 Hz 100 mA...125 A	50...60 Hz >20 A	42...2000 Hz 100 mA...30 A
<180 ms	<180 ms	<180 ms
		



A1	A2				R	T/R	T	C21	C22	C24	○
		k1	-	k2	k5	-	k6	k9	-	k10	

**CMS460-D**

## History memory

The device utilises a history memory for failsafe storing of up to 300 data records (date, time, channel, event code, measured value), so that all data about an outgoing circuit or an area can be traced back at any time (what happened when).

## Analysis of harmonics

The harmonic analysis of the measured currents can be selected via the menu item in the CMS460-D. There, the THF and the current value of the harmonics (1...40 at 50/60 Hz, 1...5 at 400 Hz) is displayed numerically and graphically. The total harmonic factor (THF) is expressed as the ratio of the harmonics r.m.s value of an alternating quantity to the r.m.s. value of the fundamental. The smaller the THF, the more sinusoidal the current signal.

## 4. Installation and connection



Only **qualified personnel** are permitted to carry out the work necessary to install, commission and run a device or system.



**DANGER**

### **Risk of electrocution due to electric shock!**

Touching live parts of the system carries the risk of:

- An electric shock
- Damage to the electrical installation
- Destruction of the device

**Before installing and connecting the device, make sure that the *installation* has been *de-energised*.** Observe the rules for working on electrical installations.

### 4.1 IFuses, max. voltage, cable lengths

- Equip the supply voltage of all system components with fuses. IEC 60364-4-43 requires protective devices for short-circuit protection. We recommend the use of 6 A fuses.
- When using busbar systems, please note: The maximum voltage of the monitored system must not exceed the nominal insulation voltage of the measuring current transformers used in the CMS460-D4.
- Select the cables and cable lengths according to the technical data on page 71 ff. If you use cables that are longer than those specified here, Bender cannot guarantee that the equipment will function safely.
- For UL-application:
  - Use at least 60/70 °C copper lines!

## 4.2 Installation instructions

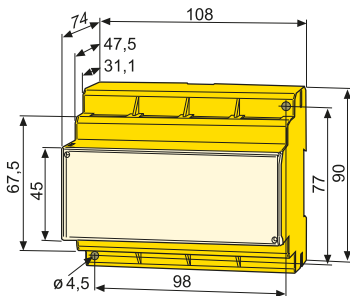
The devices are suitable for the following installation methods:

- Distribution panels according to DIN 43871 or
- DIN rail mounting according to IEC 60715
- Screw mounting using M4 screws.

Mount the measuring current transformers in accordance with the notes in the "Transformer installation" technical information. When connecting the measuring current transformers, it is essential that you observe the maximum cable lengths, the conductor cross section and that you use shielded cables.

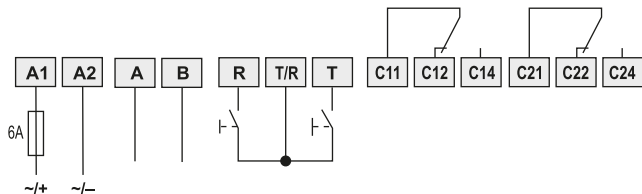
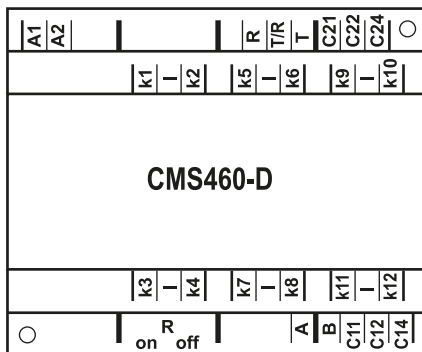
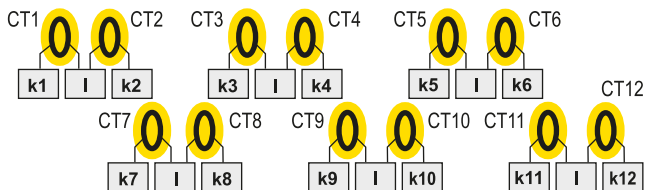
## 4.3 Connection

### 4.3.1 Dimension diagram



Dimensions given in mm.

### 4.3.2 Wiring diagram

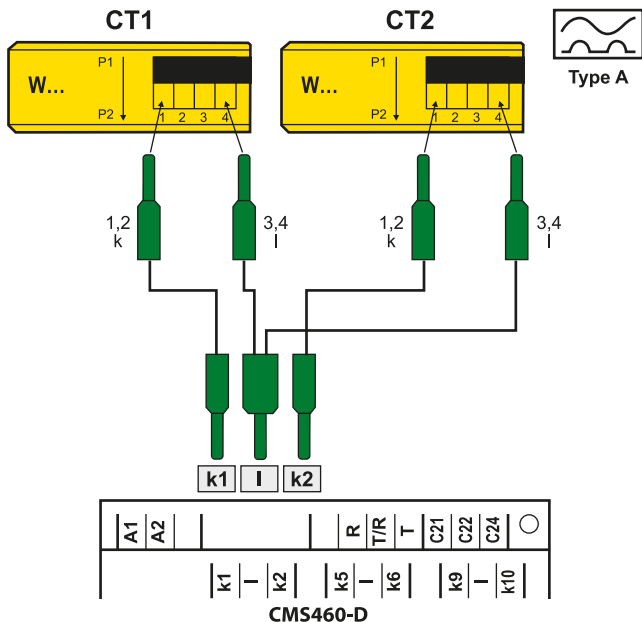


## Legend to wiring diagram

A1, A2	Connection of the supply voltage $U_S$ (see ordering information), fuse: 6 A fuse recommended.
k1, l... k12, l	Connection to measuring current transformers CT1...CT12. Measuring current transformers of the W..., WR..., WS... or WF... series can be selected for every measuring channel.
A, B	BMS bus (RS-485 interface with BMS protocol)
R, T/R	External reset button (N/O contact). The external reset buttons of several devices must not be connected to each other.
T, T/R	External test button (N/O contact). The external test buttons of several devices must not be connected to each other.
C11, C12, C14	Common alarm relay K1: A1, common alarm for alarm, pre-warning, device error
C21, C22, C24	Common alarm relay K2: A2, common alarm for alarm, pre-warning, device error
$R_{on/off}$	Activate or deactivate the terminating resistor of the BMS bus (120 $\Omega$ ).
CT	Measuring current transformers (W..., WR..., WS..., WF... series).

### 4.3.3 Connection of W..., WR..., WS... series measuring current transformers

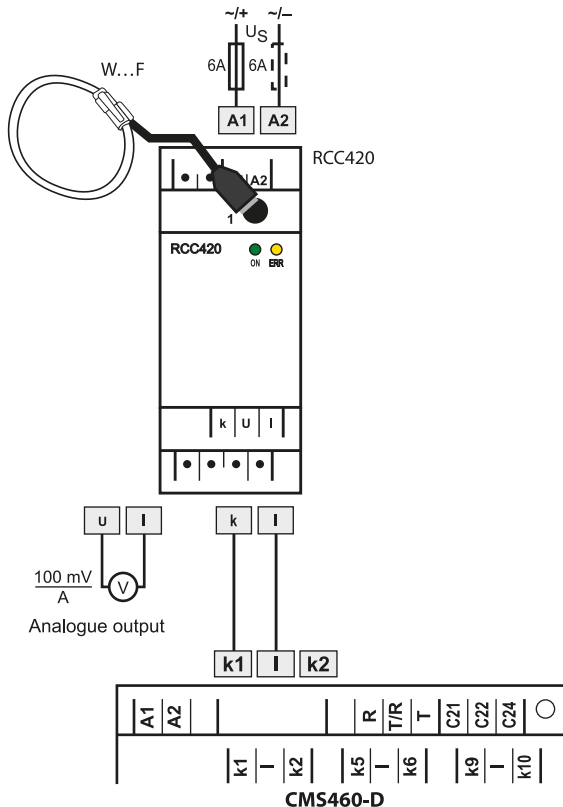
Example: Connection W... series measuring current transformers



The terminals 1 and 2 as well as the terminals 3 and 4 are bridged internally.

The connections k and I on the load current evaluator must not be interchanged!

### 4.3.4 Connection WF... series measuring current transformers







*The connections k and l on the load current evaluator must not be interchanged!*

### Legend to W...AB series measuring current transformer connection

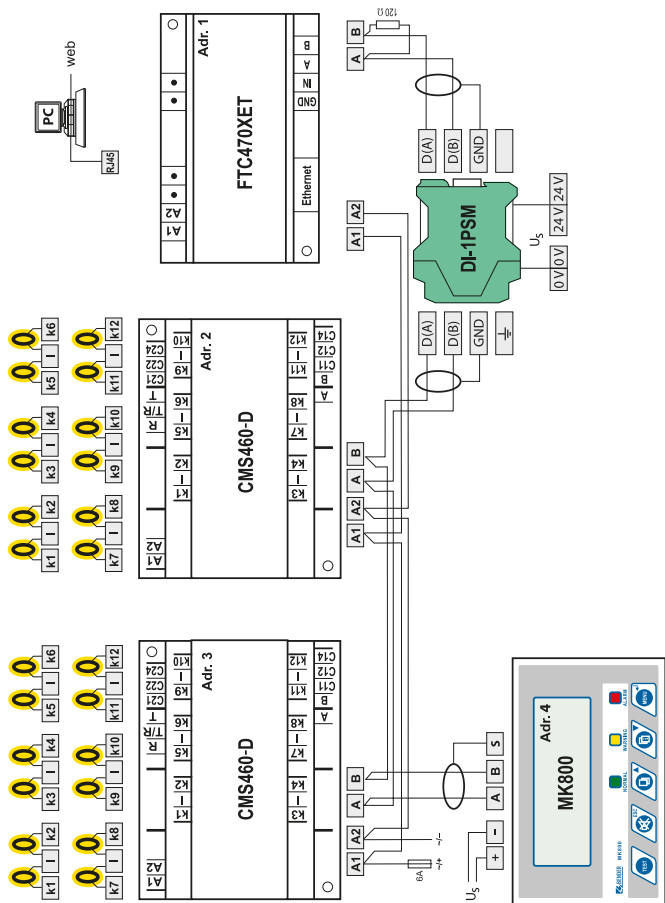
W...F	Flexible WF... series measuring current transformers
RCC420	Signal converter



*Commercial measuring current transformers are not suitable for direct connection to the CMS460 system and must not be used. Additional information is available in our "Transformer installation" manual. Only if these notes are observed will you obtain an accurate measurement result.*

#### 4.3.5 Connection example CMS460 system with FTC470XET

You will find this example on the following page.



## Legend to connection example

CMS460-D	Load current evaluators
FTC470XET	Protocol converter for connecting the BMS bus (Bender measuring device interface) with a TCP/IP (Transmission Control Protocol/Internet Protocol) network via Ethernet.
DI-1PSM	The DI-1PSM repeater only is required when the length of the cable exceeds 1200 m or when more than 32 devices are connected to the bus.
CT	W..., WR..., WS..., WF... series measuring current transformers
MK800	Remote alarm indicator and test combination for Bender monitoring systems with BMS.



## 5. Commissioning



*Opening the transparent front panel cover: Using the arrow on the bottom left-hand corner of the panel cover as a reference, lift the panel cover in an upward direction. The cover can also be removed completely. Refit the front panel cover as soon as the adjustments are completed.*

### 5.1 Before switching on

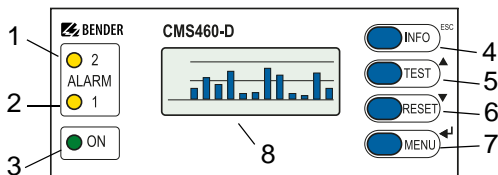
1. Does the connected supply voltage  $U_S$  match the information on the nameplate?
2. Only when busbar systems are used: Has the maximum permissible nominal insulation voltage of the measuring current transformers been observed?
3. Are you sure that the PE conductor has not been routed through the measuring current transformer at any point?
4. In mounting the measuring current transformers, have any magnetic fields that are nearby and could cause interference been taken into account?
5. Has the maximum permissible cable length for the measuring current transformers been observed?
6. Is a  $120\ \Omega$  resistor connected at the beginning and end of the BMS bus?
7. Have the maximum permissible interface cable length (1200 m) and number of BMS bus nodes (32) been observed?
8. In respect of the BMS bus node address settings, has each address only been assigned once? Is address 001 and therefore the master function, assigned?

## 5.2 Switching on

1. Connect the supply voltage of all devices connected to the BMS bus. Initially, the "ON" LED flashes on the CMS460-D and the graphic display shows the (Bender) welcome screen. The "ON" LED then lights up permanently.
2. Set the BMS bus addresses. Never assign one address twice. Check, if address 001 and thus the master function has been assigned.
3. Select the appropriate national language English, German or French (see page 59).
4. Set the CT type for each channel, see page 55
5. Start the preset function (see page 48).
6. Switch off unassigned measuring channels to avoid device errors (see page 53).
7. If a response value is exceeded or device error messages occur, this is indicated on the CMS460-D by illuminated alarm LEDs and a respective message on the graphic display. You can find information about the alarms on the CMS460-D in the "Alarm/meas.value" menu.

## 6. Operation

### 6.1 Operator control and display elements

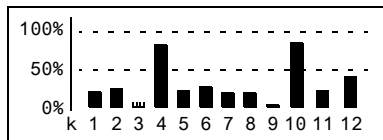


1	LED "ALARM 2" lights up if the measured value exceeds or falls below the response value "Alarm" on one channel.
2	LED „ALARM 1" lights up if the measured value exceeds or falls below the response value "Prewarning" on one channel. In the event of a device error, the LED lights up.
3	The LED "ON" lights up when the device is switched on and flashes during power on until the device is ready for operation.
4	INFO button: To query standard information ESC button: To exit the menu function without changing parameters
5	TEST button: To start an automatic test. Up button: Parameter change, scroll
6	RESET button: To acknowledge alarm and fault messages. Down button: Parameter change, scroll
7	MENU button: To toggle between the standard display, menu and alarm display Enter button: to confirm parameter changes
8	Illuminated graphic LCD

## 6.2 Working in operating mode

### 6.2.1 Standard display

In the operating mode, the CMS460-D displays a bar graph which shows what percentage of the of the set response value  $I_{n2}$  (alarm) and  $I_{n1}$  (prewarning) has been reached for each of the 12 measuring channels. .



- Channel disabled (height = 1 graduation)
- ▤ Channel enabled
- Channel enabled, current is flowing. (height  $\geq 2$  graduation)



The indication in the display is dependent on the set response value:

<b>Response value</b>	<b>Indication 0 mA</b>
10 mA...2 A	for measured values $\leq 10$ mA;
2...20 A	for measured values $\leq 0.5$ % of the response value

### 6.2.2 Alarm causes

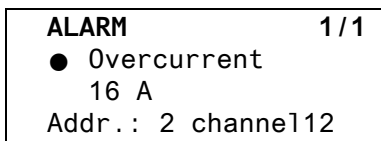
Possible causes of alarm messages:

- The value falls below or exceeds the set response value or the prewarning threshold during current or residual current measurement.
- Fault measuring current transformer or measuring current transformer connection.
- Device error (see „Device error display“ on page 67)



The CMS460-D signals prewarning and/or alarm:

- LED "ALARM 1" (prewarning) and/or LED "ALARM 2" (alarm) light depending on the type of alarm.
- Assigned common alarm relays (C...) switch.
- An alarm message is sent on the BMS bus.
- An entry is stored in the history memory.
- An entry is stored in the data logger.
- An alarm message is shown on the display.



- Line 1: ALARM, PREWARNING or FAULT  
 Alarm 1 of 1 pending alarms
- Line 2: Alarm status and alarm text (e.g. overcurrent, undercurrent, no master)
- No alarm
  - ◐ Prewarning
  - Alarm, fault
- Line 3: Currently measured r.m.s. value of the load current
- Line 4: BMS bus address of the CMS460-D and measuring channel on which the alarm has occurred.



*When measuring load current, a prewarning is indicated only in the event of an overcurrent. There is no prewarning when an undercurrent occurs.*

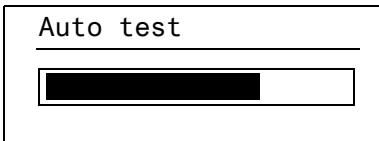
### 6.2.3 Test procedure

A test serves to check the device function (hardware components) of the CMS. There are different possibilities of starting a test:

- Select the standard display and press the "TEST" button on the front plate of the CMS460-for at least one second.
- Press an external test button connected to the CMS460-D.
- Send a test command via the BMS bus.
- Call the "TEST" function in the Control menu.

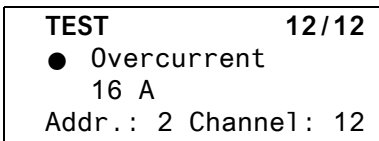
The CMS460-D responds as follows:

- LED "ALARM 1" and LED "ALARM 2" light.
- All alarm relays switch (function can be deactivated, see page 56).
- An alarm message is sent on the BMS bus.
- An entry with the suffix "TEST" is stored in the history memory.
- The progress of the test is shown on the display. The CMS460...-D then



indicates the functioning measuring channel with the highest response value set.

Press the arrow button "▼" button several times to display the functionality of the other measuring channels.



After successful testing, all LEDs must go out again, with the exception of the LED "ON" and the alarm relays must return to their initial position.

## 6.2.4 Resetting saved alarm messages (RESET)

If the fault memory is enabled, the alarm status will remain, even after the cause of the fault has been eliminated, until a "RESET" is carried out.

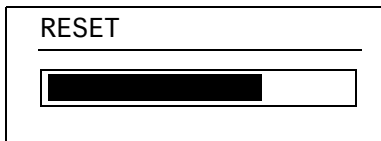
First press the "ESC" button to exit the display of the current alarm message. The "RESET" button cannot be pressed before the standard display appears (bar chart).

A RESET is carried out in the following way:

- Select the standard display and press the "RESET" button on the front plate of the CMS460-for at least one second.
- Press an external reset button connected to the CMS460-D.
- Send a reset command via the BMS bus.
- Call the "RESET" function in the Control menu.

Saved alarm messages that are no longer pending are deleted. The alarm relay drops out, the alarm LEDs go out and there are no longer any alarm messages on the BMS bus.

The CMS460-D shows the progress of the reset operation.



## 6.2.5 Displaying standard information

Press the "INFO" button. The CMS460-D display will show information about the device and the software. Use the "▼" button to scroll all the information. Please have this information to hand if you should need to contact us for assistance by telephone.

**CMS460-D**  
 10.06.14 12:59  
 Address: 2  
 Software: D233V2.42

Line 1:	Device type
Line 2:	Date, time
Line 3:	BMS bus address of the CMS460-D
Line 4:	Software version D233V... for measurement technique processes
Line 5:	Date of the measurement technique software version
Line 6:	Software version D256V... for communication processes
Line 7:	Date of communication software version
Line 8...10:	Bender address, homepage
Line 11:	Exit. Exit standard information.

## 6.3 Operation and setting

### 6.3.1 Opening the main menu

Press the "MENU" button to open the main menu.

Exit  
 1. Alarm/meas. values  
 2. % Bar graph  
 3. History

Use the following buttons in the main menu:

- ESC To exit this function without storing or to go up one menu level.
- ▲, ▼ To select menu items
- ↵ To confirm the selected menu item (Enter)



*The menu mode is exited automatically if no button is pressed for more than five minutes. Exceptions: The "Test" and "Test communication" function.*

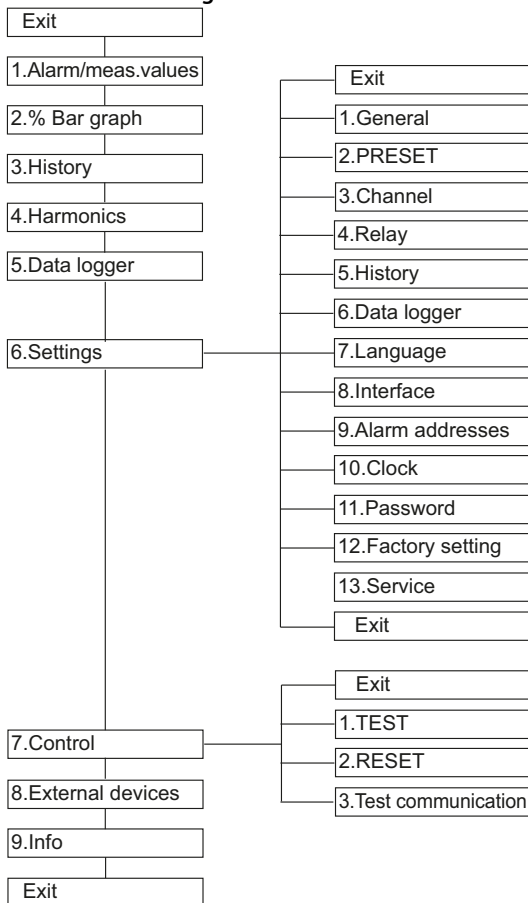


*Settings can be password protected. When an attempt is made to change settings, the entry screen for entering the password appears automatically:*

Enter  
password:  
0 0 0

*Details see „Settings menu 11: Password“, page 60.  
If you can't remember your password, contact the Bender Service.*

### 6.3.2 Menu overview diagram



### 6.3.3 Main menu functions

Menu item	Function	Page
Exit	Exit menu mode	-
1.Alarm/ meas.values	Displays the following for each measuring channel, if applicable: Prewarning, alarm, measured value, response value, channel disabled.	40
2.% Bar graph	The percentage of the total set alarm value $I_{n2}$ (alarm) and $I_{n1}$ (prewarning) which has been reached by each of the 12 measuring channels is indicated.	41
3.History	Displays the history (300 data records) with information about messages, acknowledgements and associated times. Displays the minimum and maximum overcurrent and the associated address and channel after the occurrence of an alarm.	41
4.Harmonics	Displays the following for the selected measuring channel: Measured value, THF (Total Harmonic Factor), DC component, fundamental component and harmonics in mA.	43
5. Data logger	Displays the recorded measured values (300 data records/channel) for each measuring channel.	45
6.Settings	Settings for this CMS460-D are made here.	46
7.Control	This menu offers various control options, such as TEST, RESET, Test communication.	62

Menu item	Function	Page
8. External devices	Settings on devices externally connected to the BMS bus (e.g. RCMS460-D/-L, RCMS490-D/-L, CMS460-D).	64
9. Info	Information about the device. The same display is obtained by pressing the INFO button in the operating mode (see „Displaying standard information“ on page 36).	65

## 6.4 The main menu

### 6.4.1 Menu 1: Alarm/meas.values

CMS460-D displays the following for each measuring channel: alarm, measured value, response value.

	I (d)	I (dn)
1. <input type="radio"/>	2.6A	5A
2. <input checked="" type="radio"/>	19.5A	16A
3. <input type="radio"/>	Channel disabled	

Column 1: Channel number 1...12

Column 2: Alarm status:

- No alarm
- Prewarning
- Alarm, fault

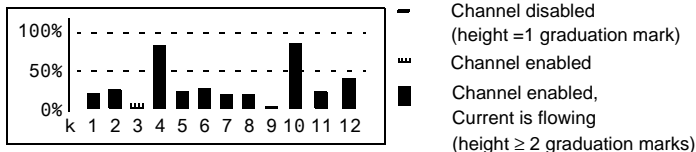
Column 3: I(d): Currently measured r.m.s.  $I$  of the load current

Column 4: I(dn): Set response value (rated operating current)  $I_n$  or "Channel disabled".



## 6.4.2 Menu 2: % Bar graph

For each of the 12 measuring channels the CMS460-D displays what percentage of the total set alarm value has been reached.



- 100 % Response value (alarm)
- 50 % Prewarning (here set to 50 %)
- 0 % Channel disabled



*The values displayed are dependent on the set response value:*

**Response value Indication 0 mA**

10 mA...2 A

for measured values  $\leq 10$  mA;

2...20 A

for measured values  $\leq 0.5$  % of the response value

## 6.4.3 Menu 3: History

The failsafe history memory stores up to 300 events (prewarnings, alarms, tests). If the history memory is full, the oldest entry will be deleted in each case in the event of an alarm, to create space for the new entry.

For details about erasing the entire history memory refer to „Settings menu 5: History“ on page 57.

```

History no. 297
Start: 01.09.14 / 15:57:00
Ack:
End: 01.09.14 / 16:07:03
    
```

- Line 1: Event number (if applicable): TEST.
- Line 2: Start of the event: Date/time
- Line 3: Event acknowledgement (e.g. by pressing the "Buzzer off" button on PRC1470, TM..., MK2430, MK800): Date/time
- Line 4: End of the event: Date/time
1. If you are searching for an event that occurred at a specific time, navigate between the different entries using the arrow buttons.
  2. Use the "J" button to display information about the current entry in the history memory.

```

History no. 297
●Overcurrent
Min. 16A/Max.19A
Addr.:2 Chan.:1
    
```

- Line 1: Data record number
- Line 2: Alarm state and alarm text (e.g. overcurrent, undercurrent)
- No alarm
  - Prewarning
  - Alarm, fault
- Line 3: Minimum and maximum measured value after an alarm has occurred.
- Line 4: Address and measuring channel of the device sending the message.

#### 6.4.4 Menu 4: Harmonics

The analysis of the harmonics of the measured currents is displayed as a bar and a current value. Harmonics are multiples of the nominal frequency.

Example: Rated frequency = 50 Hz, 2<sup>nd</sup> harmonic = 100 Hz.

CMS460-D can only determine the harmonic currents correctly if the rated frequency in menu "6.Settings -> General -> Rated frequ." matches the current being monitored.

At 50 or 60 Hz, the current value of harmonics 1...40 is displayed; at 400 Hz the current value of harmonics 1...5 is displayed.

Chan. : 1		12A
THF	█	3%
DC	█	1A
1.	██████	10A

THF: The total harmonic factor (THF) is expressed as the ratio of the harmonics r.m.s value of an alternating quantity to the r.m.s. value of the fundamental. The smaller the THF, the more sinusoidal the current signal.



*If 50 or 60 Hz are selected in the "Cut-off frequency" menu (see page 54) the THF cannot be determined. The display indicates "---".*



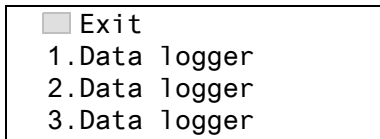
*An analysis of the harmonics cannot be carried out in disabled channels. The display indicates "---".*

- Column 1: Displays the THF, DC component and the harmonic number.
- Column 2: Bar graph of the THF (% of the r.m.s value),  
bar graph of the current value.
- Column 3: Current r.m.s., THF/load current of this measuring channel.  
Harmonics current values are updated one after another. Up-  
dating of all harmonics takes up to 15 seconds.

1. Select a measuring channel to display harmonics:
  - Use the "▲" arrow button to select the measuring channel. Press the "┐" button.
  - Use the Up/Down buttons to select a measuring channel. Press the "┐" button to confirm your selection.
2. Now you can navigate between the current harmonic values of this measuring channel using the Up/Down buttons.

### 6.4.5 Menu 5: Data logger

Up to 300 data records can be recorded for each of the 12 measuring channels. A new measured value is stored if it differs from the previous measured value by a defined percentage. You define this percentage in menu "6.Settings-> 5.Data logger-> Change". You also make settings for overwriting and deleting measured values here.



1. Use the Up/Down buttons to select the required measuring channel (measuring channel number k1...k12). Press the "↵" button.

271	01.09.14	15:57:03	3.5A
270	01.09.14	15:40:10	5.1A
269	01.09.14	15:37:15	3.6A
268	01.09.14	15:35:01	7.2A

2. You can use the Up/Down buttons to navigate between the recorded data records of this measuring channel (data record number, date, time, measured value).

## 6.4.6 Menu 6: Settings

The following menu items are available for configuring the CMS460-D:

Menu item	Function	Page
Exit	Exit settings	-
1.General	Set the fault memory, prewarning, hysteresis, rated frequency and start-up delay.	47
2.PRESET	Default setting of all response values to a selectable factor and offset value.	48
3.Channel	Set for each measuring channel: factor, response value, function (overcurrent/undercurrent), channel disabled, response delay, release delay, cut-off frequency and CT type.	50
4.Relay	Set the relay mode and type of fault that causes a switching operation for the common alarm relay.	56
5.History	Erase the history memory	57
6.Data logger	Set change in %, activate/deactivate, overwrite or delete data.	57
7.Language	Select language for menu and alarm texts.	59
8.Interface	Set the BMS bus address for the CMS460-D	59
9.Alarm addresses	Set the bus addresses for devices whose alarm messages are to be displayed on this CMS460-D.	59

Menu item	Function	Page
10.Clock	Set date format, date, time and summer time changeover.	60
11.Password	Changing and activating the password.	60
12.Factory setting	Resets all settings to factory settings.	61
13.Service	For Bender service only.	61

### 6.4.6.1 Settings menu 1: General

In this menu you make settings that apply to this device and therefore to all measuring channels.

#### 1.Fault memory

Faults that only occur temporarily can be saved.

- on                    After eliminating the cause of fault all alarm messages remain stored until a reset is carried out.
- off                   CMS460-D exits the alarm mode as soon as the cause of fault is eliminated.

#### 2.Prewarning

Setting as a percentage of the response value. Setting range: 10...100 %, resolution of setting 1 %.

#### 3.Hysteresis

If the measured value is relatively close to the response value, the CMS460-D would constantly switch between the alarm and normal states. If a hysteresis of 20 % is set, the alarm status is not exited until the measured value is 20 % below or above the response value. Setting range: 2...40 %, resolution of setting 1 %.

## 4. Frequency

Select the rated frequency of the current being monitored. The correct frequency must be selected for the CMS460 to determine the harmonic current values properly.

Setting options: DC, 50 Hz, 60 Hz, 400 Hz.

## 5. Start-up delay $t$ (start-up)

Time delay after switching the CMS460 on.

No alarm message is generated during this period. This time delay is required if the CMS460-D and the system to be monitored are switched on simultaneously. Currents caused by switching operations are ignored. Setting range:

0...99 s. Resolution of settings as follows:

Setting range	Resolution of setting
0...50 ms	5 ms
60...200 ms	10 ms
250...500 ms	50 ms
600 ms...2 s	100 ms
2.5...5 s	0.5 s
6...20 s	1 s
25...50 s	5 s
60...99 s	10 s

### 6.4.6.2 Settings menu 2: PRESET

Default setting of all response values to a specified factor and offset value. This default setting facilitates commissioning of new installations. Alarm messages as a result of not previously set response values can be avoided. The new response value is determined as follows:

1. The currently measured value is multiplied by the appropriate factor.
2. The specified offset value will be added

Displayed as a formula:

$$\text{Response value} = (\text{currently measured value} \times \text{factor}) + \text{Offset}$$



<input type="checkbox"/>	Exit	
1.	Factor:	* 3
2.	Offset:	30 mA
3.	PRESET	

### 1.Factor (for PRESET)

Set the multiplication factor for the latest measured value. Setting range: 1...99 %, resolution of setting 1 %.

Recommended setting (factory setting): Factor 3

### 2.Offset (for PRESET)

Set the offset value that is to be added to the product of the "current measured value x factor". Setting range: 0...20 A, resolution of setting:

Setting range	Resolution of setting
0...20 mA	1 mA
25...50 mA	5 mA
60...200 mA	10 mA
250...500 mA	50 mA
600 mA... 2 A	100 mA
2.5 A...5 A	0.5 A
6 A...20 A	1.0 A

Recommended setting (factory setting): Offset 30 mA

### 3.PRESET

Make sure that all existing insulation faults are eliminated before using the preset function!

Presetting is carried out for all measuring channels on this device.

Exceptions:

- If a channel is disabled the response value will not be changed.
- When the current measured value is 0 mA, the smallest possible response value is set: Type A measuring current transformer : 100 mA

- If the PRESET routine determines a value that exceeds the maximum response value (the highest possible response value is set).

To prevent unwanted execution of this function, the entry must be confirmed once more.

### 6.4.6.3 Settings menu 3: Channel

You make the measuring channel settings in this menu (either individually or for all channels (1...12) simultaneously). Selecting a measuring channel:

1. Use the "▲" button to select the measuring channel. Press the "↵" button.
2. Use the Up/Down buttons to select a single measuring channel (e.g. 1) or all measuring channels (1...12). Press the "↵" button to confirm your selection.

Setting an individual channel:

Chan.:	1
<input type="checkbox"/> Exit	
1.Factor:	*1
2.Resp. val...:	16.0A

Setting all channels:

Chan.:	1..12
<input type="checkbox"/> Exit	
1.Factor:	*1
2.Resp. val...:	16.0A



*If the measuring channel settings differ only slightly, the following procedure is recommended:*

- first set all the measuring channels (1...12) to the same value
- then modify the settings of an individual measuring channel

## 1. Factor (for measuring current transformers)

Setting of a factor to adapt the CMS460-D to connected measuring current transformers. The following factor setting ranges are available depending on the CT type and the application. This setting menu has no function (display: --), when the channel is disabled.

Select:

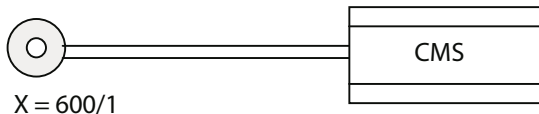
- \*1 Bender measuring current transformers (W..., WR..., WS..., WF...);
- \*1...\*10 For measuring current transformers with a different transformation ratio (e.g. if third-party measuring current transformers are connected via a Bender measuring current transformer).
- /2.../10 When the conductor to be monitored is wound through the measuring current transformer several times in order to amplify the signal.

### Examples for the factor determination

$X$  = transformation ratio,  $N$  = number of turns through the measuring current transformer (wire up)

#### Example 1:

Bender measuring current transformers with a transformation ratio of 600/1

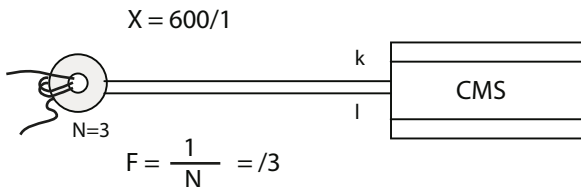


Factory setting:

Factor: \*1

#### Example 2:

The wire to be monitored is "wound" several times through the Bender current transformer in order to amplify the signal.



Setting:

Factor:     /3

## 2.Response value

The response value is the value at which an alarm is output.



*For each measurement tolerances have to be considered (measuring current transformers, CMS460-D). According to IEC 62020, the set response value must not be exceeded. Therefore, the CMS460-D must be activated when 50...100 % of this value have been reached.*

*Prewarning must be indicated before CMS460 is activated (i.e. x % of 50...100 % of the response value).*

*The current measuring channels k1...k12 have positive tolerances as regards the response values.*

The setting options for the response value are dependent on the settings in the menu "Channel -> transformer":

Type A            100 mA...125 A (42...2000 Hz)

Flex:             100 mA...30 A (42...2000 Hz)

Resolution of settings:

Setting range	Resolution of setting
100...200 mA	10 mA
250...500 mA	50 mA
600 mA... 2 A	100 mA
2.5 A...5 A	0.5 A
6 A...20 A	1.0 A
25 A...50 A	5.0 A
60 A...125 A	10.0 A

### 3.Function

Monitoring the measuring channel for overcurrent or undercurrent. Unused measuring channels have to be disabled.

- > Alarm when the response value is exceeded.
- < Alarm when the value falls below the set response value.
- off Measuring channel disabled.

### 4.Response delay $t(\text{on})$

Response delay starts when a new alarm has been triggered.

Setting range: 0...999 s.

Resolution of settings: the same as for delay on release  $t(\text{off})$  (see page 53).

### 5.Delay on release $t(\text{off})$

If the condition that triggered the alarm no longer exists, the CMS460-D terminates its alarm once the release delay has elapsed.

Setting range: 0...999 s. Resolution of settings:

Setting range	Resolution of setting
0...50 ms	5 ms
60...200 ms	10 ms
250...500 ms	50 ms
600 ms...2 s	100 ms
2.5...5 s	0.5 s
6...20 s	1 s
25...50 s	5 s

60...200 s	10 s
250...500 s	50 s
600...999 s	100 (99) s

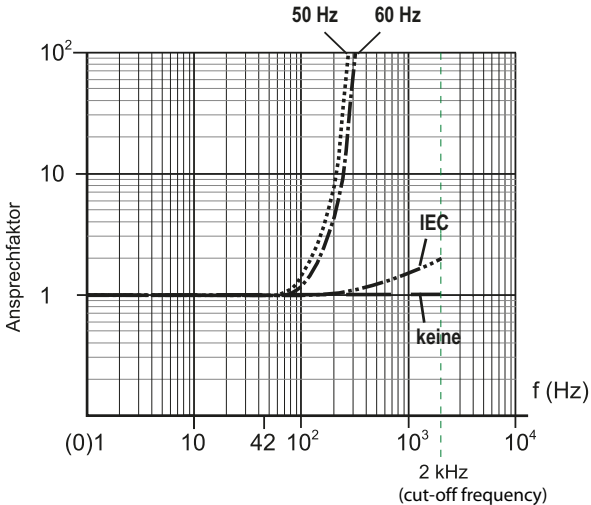
## 6. Cut-off frequency

Set the characteristics for the frequency response of load current measurement  $I_n$  and current measurement  $I$ .

Param.	Objective
50 Hz	Plant protection: Only evaluates the fundamental component of the current measurement.
60 Hz	Plant protection: Only evaluates the fundamental component of the current measurement.
IEC	Frequency response acc. to IEC 60990: Above 200 Hz (approx.), the set response value increases according to the hazard curve in IEC 60990.
None	Fire protection: Response factor remains the same over the entire frequency range.

The frequency response of the equipment can be set for a linear frequency response (up to the maximum frequency of 2000 Hz) if used for fire protection or for a frequency response in accordance with IEC 60990 for personnel protection. For plant protection, the residual current is measured up to the rated system frequency. The figure below shows the corresponding frequency response.

## Frequency response




$$\text{Response factor} = \frac{I(d)}{I(d_n)}$$


$I(d)$  Load current: Currently measured r.m.s. value of the load current.

$I(d_n)$  Rated operating current  $I_n$ : Set response value

## 7. Transformer

Select the type of measuring current transformer.

Type A  Pulsating current sensitive W..., WR..., WS... series measuring current transformers

Flex.  Flexible measuring current transformers WF...

## 8. CT monitor.

This menu has no function.

#### 6.4.6.4 Settings menu 4: Relays

In this menu, you make the settings for the two common alarm relays K1 (C11, C12, C14) and K2 (C21, C22, C24) either individually or for both relays. Select the relay:

1. Use the arrow button "▲" to set the relay. Press the "↵" button.
2. Use the Up/Down buttons to select one relay (1, 2) or both relays (1...2). Press the "↵" button to confirm your selection.

Set one relay:

Relay:	1
<input type="checkbox"/> Exit	
1. Relay mode:	N/O-T
2. Alarm:	on

Set both relays:

Relay:	1..2
<input type="checkbox"/> Exit	
1. Relay mode:	N/O-T
2. Alarm:	on

### 1. Relay mode

Set the relay mode

N/O	operation. Relay only switches in the event of an alarm.
N/C	operation. Relay only switches in the event of an alarm.
N/O-T	operation. Relay switches in the event of an alarm or a test.
N/C-T	operation. Relay switches in the event of an alarm or a test.
off	Relay contacts are always open*
on	Relay contacts are always closed*

\* This function can also be activated via the BMS bus. Sending the command "off" or "on" via the BMS bus may cause the relay to switch. This relay does not respond to alarms. It serves merely as a signal converter BMS bus/relay contact message.



## 2.Alarm

on	Relay switches in the event of an alarm.
off	Relay does not switch in the event of an alarm.

## 3.Prewarning

on	Relay switches in the event of a prewarning.
off	Relay does not switch in the event of a prewarning.

## 4.Device error

on	Relay switches in the event of a device error
off	Relay does not switch in the event of a device error.

## 5.Ext. Alarm

on	Relay switches in the event of an external alarm*
off	Relay does not switch in the event of an external alarm*

\* Alarm on an external device the address of which is set to "on" in the "Alarm addresses" menu (see „Settings menu 9: Alarm addresses“, page 59).

### 6.4.6.5 Settings menu 5: History

Here the history memory can be deleted completely. Use the "↵" button to confirm that the memory is to be deleted.

### 6.4.6.6 Settings menu 6: Data logger

You make the settings for the data logger recording of the measured values for each measuring channel in this menu.

Select a measuring channel:

1. Use the arrow button "▲" to set the measuring channel. Press the "↵" button.
2. Use the Up/Down buttons to select a single measuring channel or all measuring channels (1...12). Press the "↵" button to confirm your selection.

Chan.:1
<input type="checkbox"/> Exit
1.Modific.:10%
2.Overwrite:yes



*If the measuring channel settings only differ slightly, we recommend to proceed as follows:*

- first set all the measuring channels (1...12) to the same value*
- then modify the settings of an individual measuring channel*

### 1. Modific.

A new measured value is saved if it differs from the previous measured value by the percentage defined here.

Setting range: 0...100 %, resolution of setting 1 %.

### 2.Overwrite

Yes If the memory (300 measuring values) for this measuring channel is full, the oldest measured value is deleted to create space for the new measured value entry.

No Data logger records 300 measured values then stops.

### 3.Delete

The recorded measured values of this measuring channel are deleted. To prevent unwanted execution of this function, the entry must be confirmed once more.

### 6.4.6.7 Settings menu 7: Language

Select the language for the menu and the alarm texts.

Setting options: English, Deutsch or Français.

### 6.4.6.8 Settings menu 8: Interface

Set the BMS bus address of the CMS460-D. The device with address 1 has the master function on this bus. There must be one device with address 1 in each CMS460 system.

Setting range: Adresses 1...90

### 6.4.6.9 Settings menu 9: Alarm addresses

Setting of the bus addresses (1...150) externally connected to the BMS bus, the alarm messages of which are to be displayed as standard messages on this CMS460-D. Set the addresses of devices whose messages are to be displayed to "on". Addresses set to "on" will be looked for on the BMS bus; if a device cannot be found on the bus, a corresponding message will appear. The address of this device is automatically set to "On".

<input type="checkbox"/>	Exit
1.Address:	on
2.Address:	off
3.Address:	off

on                      Messages of this device will be displayed.  
off                     Messages of this device will not be displayed.

### 6.4.6.10 Settings menu 10: Clock

Set the date format, date, time, and summer time changeover.



*Set the time and date on the BMS bus master (addr. 1). This setting is applied to all slaves. The setting is synchronised every hour.*

*The "Clock" menu setting remains stored for approx. 2 h after power supply failure.*

#### 1.Format

Select the German or American format.

d.m.y	German format (day.month.year)
m-d-y	American format (month-day-year)

#### 2.Date

Set the date (e.g. 20.07.2014).

#### 3.Time

Set the time (e.g. 16:44).

#### 4.Summertime

Setting for automatic switchover to Central European Summer Time (CEST).

Auto	automatic switchover
off	No switchover (wintertime is retained)

### 6.4.6.11 Settings menu 11: Password

Change password, activate/deactivate password.

#### 1.Password

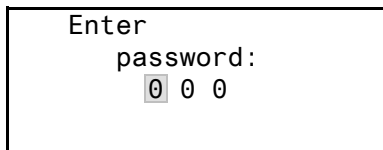
Change password. Factory setting: 000

#### 2.Status

Activate or deactivate password protection.



*Settings can be password protected. If the password is activated (enabled), all settings continue to be displayed. When an attempt is made to change settings, the entry screen for entering the password appears automatically:*



Enter  
password:  
0 0 0

*Once a valid password has been entered, access will be given to settings in all menus (except the Service menu) until the menu mode is exited.*

*If you can't remember your password, contact the Bender Service.*

#### **6.4.6.12 Settings menu 12: Factory settings**

Resets every setting to factory setting. Factory settings are given in parentheses „( )\*“ in the technical data.

#### **6.4.6.13 Settings menu 13: Service**

This menu is only intended for Bender service staff.

## 6.4.7 Menu 7: Control

This menu offers various options for controlling the CMS:

Exit	Exit settings
1.TEST	Call a test
2.RESET	Call a reset
3.Test communication	Test communication between the CMS460-D and other BMS devices.

### 6.4.7.1 Control menu 1: TEST

Call a test (also refer to „Test procedure“ on page 34). To prevent unwanted execution of this function, the entry must be confirmed once more.

### 6.4.7.2 Control menu 2: RESET

Call a reset (also see „Resetting saved alarm messages (RESET)“ on page 35). To prevent unwanted execution of this function, the entry must be confirmed once more.

### 6.4.7.3 Control menu 3: Test communication

This function can be used to test the communication between the CMS460- and other BMS devices. For this purpose, the CMS460-sends an alarm message via the BMS bus until the "test communication" function is exited. A connected evaluating device (FTC..., PRC1470, MK2430, MK800, TM...) must display this alarm.

<input type="radio"/> Channel disabled
<input type="checkbox"/> Exit 1.Chan.: --

1. Use the arrow button "▼" to set the measuring channel. Press the "↵" button.
2. Use the Up/Down buttons to select a measuring channel. Press the "↵" button to confirm your selection. The alarm is sent on the BMS bus. This is presented by the alarm indication ●. Depending on the function set for the measuring channel, an alarm, overcurrent or undercurrent is displayed and sent.

Example: Alarm "Overcurrent" on measuring channel 1.

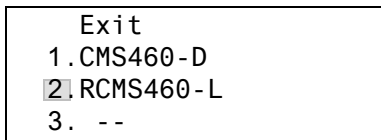
<input checked="" type="radio"/> Overcurrent
Exit <input type="checkbox"/> 1.Chan.: 1

3. Press the "ESC" button to exit the function.

### 6.4.8 Menu 8: External devices

This menu can be used for setting and operating external devices connected via the BMS bus to this CMS460-D. In this way, for example, RCMS460-L or other CMS460-devices can be set. The menu options of the external devices available via this function are indicated in the CMS460-D display. Settings modified at the external device are automatically stored in the external device.

After calling up this menu, the address and type of devices already stored will be displayed. The display is updated every five minutes.

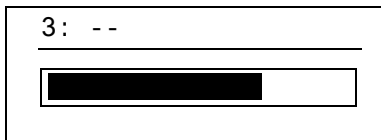


Use the Up/Down buttons to select the address of the external device and confirm with the "↵" button.



*External devices connected to the BMS bus or switched on for the first time will not be displayed immediately by the CMS460-D in the external devices list. The list will be updated only after a few minutes. However, it is not necessary for the list to appear in order to select and set the external device, which can be achieved via the address.*

The device is being searched:





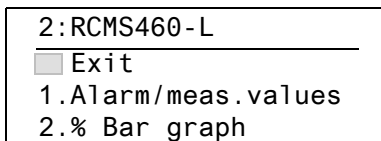
If "no access to the menu" appears, press the "ESC" button to exit the display.

Possible causes are:

- No device with this address available.
- Connected device does not support this programming function.
- Access not possible at the moment.

The "External devices" menu is not suitable to program your own device. If you still attempt to do this, the error message "Own address" will appear. Press the "ESC" button to exit this menu.

When the device has been recognised, the CMS460-D reads the current settings of the connected device. The address and the device type is displayed in the first line.



#### 6.4.9 Menu 9: Info

The "Info" menu shows standard information about this CMS460-D (for details refer to „Displaying standard information“ on page 36).



## 7. Tests, service, troubleshooting

### 7.1 Periodic verification

The CMS460 system automatically monitors itself during operation. We recommend to activate the test function on each connected CMS460-D. There are different possibilities of starting a test:

- Select the standard display and press the "TEST" button on the front plate of the CMS460-D for at least one second.
- Press an external test button connected to the CMS460-D.
- Send a test command via the BMS bus.
- Call the "TEST" function in the Control menu.

Observe the applicable national and international standards which require regular testing of electrical equipment.

### 7.2 Maintenance and service

The CMS460 system does not contain any parts that must be maintained. For commissioning, Bender also offers on-site service and training courses.

Please contact our Service Department for more information. You will find the address on page 10 of this manual.

### 7.3 Troubleshooting

#### 7.3.1 Device error display

In the event of a fault an "Error code" is displayed. Please have this device information to hand if you should need to contact us for assistance by telephone.

Error code	Description
1	Measurement technique: Fault parameter memory (EEPROM/FLASH)
2	Measurement technique: Fault data memory (RAM)
4	Measurement technique: No boot loader available
11	Measurement technique: Device not calibrated
12	Measurement technique: Wrong measurement p.c.b., incorrect mounting.
13	Measurement technique: Hardware error after performing a self test.
71	BMS interface: No master available resp. has not been queried by a master for five minutes.
72	BMS interface: Fault RS-485 interface

## Display in the event of a fault

Device error: xx

xx = Error code

### 7.3.2 Device error display (channel-related)

LED "ALARM 1" lights up. The programmed common alarm relay switches. The following test is shown on the display of the CMS460-D:

<b>Fault</b>	<b>1/1</b>
● Device error	
11	
Addr.: 2	Channel: 4

Line 1: FAULT, Alarm 1 of 1 pending alarms

Line 2: Alarm status and alarm text

○ No alarm

◐ Prewarning

● Alarm, fault

Line 3: Error code (see „Device error display“ on page 67)

Line 4: BMS bus address of the CMS460-D and measuring channel on which the alarm has occurred.

Possible causes:

- Incorrect basic programming of the CMS460-D.
- Wrong p.c.b. assembly at four channels in succession.
- Internal memory fault.
- Faulty channels after test.

The device errors remain saved until the "RESET" button is pressed. An entry is made in the history memory with the suffix "device error".

If a device error continues to exist after a RESET, the CMS460 has to be replaced.

### 7.3.3 External alarm

LED "ALARM 2" lights up. The programmed common alarm relay switches.

Possible causes:

- Alarm message from an external device
- Device failure



## 8. Data

### 8.1 Technical data

**Insulation coordination acc. to IEC 60664-1/IEC 60664-3 for the versions:**

#### a) CMS460-D1

Supply voltage  $U_s$  ..... DC 24...75V / AC 24...60 V (AC/DC  $\pm 20\%$ )

Supply voltage frequency ..... DC, 50/60 Hz

Rated insulation voltage ..... **100 V**

Overvoltage category/pollution degree ..... III/3

Rated impulse voltage ..... **2.5 kV**

Protective separation (reinforced insulation) between ..... (A1, A2) - (k1, I...k12, R, T/R, T, A, B)

Voltage test acc. to IEC 61010-1 ..... 1.344 kV

Rated insulation voltage ..... **250 V**

Overvoltage category/pollution degree ..... III/3

Rated impulse voltage ..... **4 kV**

Basic insulation between: ..... (A1, A2), (k1, I...k12, R, T/R, T, A, B) -  
(C11, C12, C14), (C21, C22, C24), (11,14), (21,24), (31,34), (41,44), (51,54), (61,64), (71,74), (81,84),  
(91,94), (101,104), (111,114), (121,124)

Basic insulation between: ..... (11, 14) - (21, 24) - (31, 34) - (41, 44) - (51, 54) - (61, 64)

Voltage test acc. to IEC 61010-1 ..... 2.21 kV

Rated insulation voltage ..... **250 V**

Overvoltage category/pollution degree ..... III/3

Rated impulse voltage ..... **6 kV**

Protective separation (reinforced insulation) between ..... (C11, C12, C14) - (C21, C22, C24) -  
(11, 14, 21, 24, 31, 34) - (41, 44, 51, 54, 61, 64) - (71,74) - (81,84) - (91,94) - (101,104) - (111,114) - (121,124)

Voltage test acc. to IEC 61010-1 ..... 3.536 kV

**b) CMS460-D2**

Supply voltage  $U_S$  ..... AC/DC 100...240 V (-20...+15%)  
 Supply voltage frequency ..... DC, 50/60 Hz

Rated insulation voltage ..... **250 V**

Overvoltage category/pollution degree ..... III/3

Rated impulse voltage ..... **6 kV**

Protective separation (reinforced insulation) between ..... (A1, A2) - (k1, l...k12, R, T/R, T, A, B),  
 (C11, C12, C14), (C21, C22, C24), (11,14), (21,24), (31,34), (41,44), (51,54), (61,64), (71,74), (81,84),  
 (91,94),(101,104), (111,114), (121,124)

Protective separation (reinforced insulation) between ..... (C11, C12, C14) - (C21, C22, C24) -  
 (11, 14, 21, 24, 31, 34) - (41, 44, 51, 54, 61, 64) - (71,74) - (81,84) - (91,94) - (101,104) - (111,114) - (121,124)

Voltage test acc. to IEC 61010-1 ..... 3.536 kV

Rated insulation voltage ..... **250 V**

Overvoltage category/pollution degree ..... III/3

Rated impulse voltage ..... **4 kV**

Basic insulation between: ..... k1, l...k12, R, T/R, T, A, B) - (C11, C12, C14), (C21, C22, C24)

Basic insulation between: ..... (11, 14) - (21, 24) - (31, 34) - (41, 44) - (51, 54) - (61, 64)

Voltage test acc. to IEC 61010-1 ..... 2.21 kV

**Measuring circuit**

External measuring current transformers ..... W... , WR... , WS... , WF... series (type A)

Load ..... 1  $\Omega$

Rated insulation voltage (measuring current transformer) ..... 800 V

Operating characteristics acc. to IEC 60755 ..... type A  
 ..... depending on measuring current transformer series (type A)\*

Rated frequency ..... 42...2000 Hz (type A)

Cut-off frequency ..... none, IEC, 50 Hz, 60 Hz (none)\*

Measuring range ..... 100 mA...125 A (measuring current transformer type A)

..... 100 mA...30 A (measuring current transformer Flex)

..... Crest factor up to 10 A = 4, up to 125 A = 2

Rated operating current  $I_{n2}$  (alarm) ..... 100 mA...125 A (16 A overcurrent)\*

Rated operating current  $I_{n1}$  (prewarning) ..... 10...100%  $\times I_{n2}$ \*

Preset for alarm ..... offset: 0...20 A (1 A)\* and /x factor 1...99 (3)\*



Relative uncertainty .....	+10...-20 %
Hysteresis .....	2...40% (20%)*
Factor for additional CT .....	/2...10; x1...10 (x1)*
Number of measuring channels (per device/system) .....	12/1080

### Time response

Start-up delay $t_{(start-up)}$ per device .....	0...99 s (0 ms)*
Response delay $t_{on}$ per channel .....	0...999 s (200 ms)*
Delay on release $t_{off}$ per channel .....	0...999 s (200 ms)*
Operating time $t_{ae}$ at $I_n = 1 \times I_{n1/2}$ .....	$\leq 180$ ms
Operating time $t_{ae}$ at $I_n = 5 \times I_{n1/2}$ .....	$\leq 30$ ms
Response time $t_{an}$ tan for current measurement .....	$t_{an} = t_{ae} + t_{on1/2}$
Scanning time for all measuring channels (current measurement) $\leq 180$ ms	
Recovery time $t_b$ .....	500...600 ms

### Displays, memory

Display range, measuring value .....	< 10 mA...125 A (CT type A)
.....	< 10 mA...30 A (measuring current transformer Flex)
Operating uncertainty.....	$\pm 10$ %
LEDs.....	ON/ALARM
LC display .....	backlit graphical display
History memory .....	300 data records
Data logger.....	300 data records per measuring channel
Password.....	off/0...999 (off)*
Language .....	D, GB, F (GB)*
Fault memory alarm relay .....	on/off (off)*

### Inputs/outputs

Test/reset button .....	internal/external
Cable length for external test/reset button .....	0...10 m

### Interface

Interface/protocol .....	RS-485/BMS
Baud rate .....	9.6 kbit/s
Cable length .....	0...1200 m
Recommended cable (shielded, shield connected to PE on one side) .....	min. J-Y(St) min. 2x0.8

**For UL applications:** ..... Copper lines at least 60/70 °C

Terminating resistor .....	120 Ω (0.25 W) connectable via DIP switch
Device address, BMS bus .....	1...90 (2)*

### Cable lengths for W..., WR..., WS..., WF... series measuring current transformers

Single wire $\geq 0.75 \text{ mm}^2$ .....	0...1 m
Single wire, twisted $\geq 0.75 \text{ mm}^2$ .....	0...10 m
Shielded cable $\geq 0.5 \text{ mm}^2$ .....	0...40 m
Recommended cable (shielded, shield connected to terminal I at one end, must not be earthed).....	J-Y(St)Y min. .2x0.8

### Switching elements

Number of changeover contacts .....	2 x 1 changeover contacts
Operating principle .....	N/C or N/O operation (N/O operation)*
Electrical endurance, number of cycles .....	10,000

### Contact data acc. to IEC 60947-5-1

Utilisation category .....	AC-13	AC-14	DC-12	DC-12	DC-12
Rated operational voltage.....	230 V	230 V	24 V	110 V	220 V
Rated operational current (common alarm relay).....	5 A	3 A	1 A	0.2 A	0.1 A
Rated operational current (alarm relay).....	2 A	0.5 A	5 A	0.2 A	0.1 A
Minimum contact rating.....	1 mA at AC/DC $\geq 10 \text{ V}$				

### Environment/EMC

EMC.....	IEC 61326-1
Operating temperature.....	-25 °C
Climatic class acc. to IEC 60721	
Stationary use (IEC 60721-3-3).....	3K5 (except condensation and formation of ice)
Transport (IEC 60721-3-2).....	2K3 (except condensation and formation of ice)
Long-term storage (IEC 60721-3-1).....	1K4 (except condensation and formation of ice)
Classification of mechanical conditions acc. to IEC 60721	
Stationary use (IEC 60721-3-3).....	3M4
Transport (IEC 60721-3-2).....	2M2
Long-term storage (IEC 60721-3-1).....	1M3

## Connection screw-type terminals

Connection properties:

Rigid/flexible/conductor sizes .....	0.2 . . . 4 / 0.2 . . . 2.5 mm <sup>2</sup> /AWG 24 . . . 12
Multi-conductor connection (2 conductors with the same cross section):	
Rigid/flexible .....	0.2 . . . 1.5 / 0.2 . . . 1.5 mm <sup>2</sup>
Stripping length .....	8 . . . 9 mm
Tightening torque .....	0.5 . . . 0.6 Nm

## Other

Operating mode .....	continuous operation
Mounting .....	display-oriented
Degree of protection, internal components (IEC 60529) .....	IP30
Degree of protection, terminals (IEC 60529) .....	IP20
Enclosure material .....	polycarbonate
Flammability class .....	UL94V-0
Screw fixing .....	2 x M4
DIN rail mounting acc. to .....	IEC 60715
Software version measurement technique .....	D233 V2.42
Software version display .....	D256 V2.29
Power consumption .....	≤ 10 VA
Weight .....	≤ 360 g

( ) \* Factory setting

## 8.2 Standards, approvals, certifications



### Standards

Observe the applicable national and international standards.

- DIN EN 62020 (VDE 0663):2005-11
- IEC 62020 (2003-11) Ed. 1.1..

The operating manuals for the individual system components provide you with information about the standards that apply to that particular device.

## 8.3 Ordering information

### Load current evaluators

Type	Supply voltage $U_s^*$	Art. No.
CMS460-D-1	DC 24...75 V AC 24...60 V, 50/60 Hz	B 9405 3017 B 7405 3017
CMS460-D-2	DC 100...240 V AC 100...240 V, 50/60 Hz	B 9405 3018 B 7405 3018

B7...: Devices with push-wire terminal

\* For UL applications:  $U_s \text{ max} = \text{DC } 250 \text{ V}$   
 $\text{AC } 250 \text{ V, } 50/60 \text{ Hz}$

## Accessories

Type	Supply voltage $U_S$	Art. No.
DI-1 (RS-485 repeater)	DC 10...30V*	B 9501 2015
DI-1PSM (RS-485 repeater)	AC/DC 24 V $\pm 20\%$	B 9501 2044
AN471 (power supply unit for DI-1)	AC 50...60 Hz 230 V/ AC, DC 20 V	B 924 189
XM460 mounting frame, 144 x 72 mm		B 990 995

\* Absolute values

## Protocol converter/Alarm indicator and test combinations

Type	Supply voltage $U_S$ */Description	Art. No.
COM460IP	BMS-Ethernet-Gateway for the connection of the Bender measuring device interface to TCP/IP networks AC/DC 76...276 V */ AC 42...460 Hz/DC	B 9506 1010
COM460IP-24 V	BMS-Ethernet Gateway DC 16...94 V AC 16...72 V, 50...60 Hz	B 9506 1020
COM460IP- Option A	BMS-Ethernet Gateway; Individual text messages for all devices/ channels E-mail in the event of an alarm	B 9506 1011

Type	Supply voltage $U_S^*$ /Description	Art. No.
COM460IP- Option B	BMS-Ethernet Gateway; Modbus/TCP server with max. 14700 BMS nodes	B 9506 1012
COM460IP- Option C	BMS-Ethernet Gateway; Parameter setting for BMS devices	B 9506 1013
COM460IP- Option D	BMS-Ethernet Gateway; Visualisation of BMS devices	B 9506 1014
CP700	Condition Monitor	B 9506 1030
COM462RTU	BMS Modbus RTU gateway AC/DC 76...276 V */ AC 42...460 Hz/DC	B 9506 1022
MK800A-11**	Alarm indicator and test combination acc. to DIN VDE 0100-710, with BMS bus and USB interface, 16 digital inputs, one relay output, alarm texts programmable via interfaces and personal computer, standard text display. Version: surface-mounting enclosure; Menu languages: German English.	B 9510 0102
MK800A-12**	Alarm indicator and test combination acc. to DIN VDE 0100-710, with BMS bus and USB interface, alarm texts programmable via interfaces and personal computer, standard text display. Version: surface-mounting enclosure; Menu languages: German, English.	B 9510 0103

Type	Supply voltage $U_S^*$ /Description	Art. No.
MK2430-11	Alarm indicator and test combination in accordance with IEC 60364-7-710, with BMS bus and USB interface, 12 digital inputs, one relay output, alarm texts programmable via interfaces and personal computer, standard text display. Version: Flush-mounting enclosure	B 9510 0001
MK2430-12	Alarm indicator and test combination in accordance with IEC 60364-7-710, with BMS bus and USB interface, alarm texts programmable via interfaces and personal computer, standard text display. Version: Flush-mounting enclosure	B 9510 0002
MK2430P-11	As MK2430-11, but factory-programmed	B 9510 0003
MK2430P-12	As MK2430-12	B 9510 0004
MK2430A-11	As MK2430-11, but with surface-mounting enclosure	B 9510 0005
MK2430A-12	As MK2430-12, but with surface-mounting enclosure	B 9510 0006
MK2430PA-11	As MK2430A-11, but factory-programmed, surface-mounting enclosure version	B 9510 0007
MK2430PA-12	As MK2430A-12, but factory-programmed, surface-mounting enclosure version	B 9510 0008
MK2430S-11	As 2430-11, but front plate with screw fixing	B 9510 0011

Type	Supply voltage $U_S^*$ /Description	Art. No.
MK2430S-12	As MK2430-12, but front plate with screw fixing	B 9510 0012

\* Absolute values

\*\* Other versions on request

## Pulsating current sensitive measuring current transformers

Bender measuring current transformers

Type	Inside diameter/mm	Design type	Art. No.
W20	20	circular	B 9808 0003
W35	35	circular	B 9808 0010
W60	60	circular	B 9808 0018
W120	120	circular	B 9808 0028
W210	210	circular	B 9808 0034
WR70x175	70 x 175	rectangular	B 9808 0609
WR115x305	115 x 305	rectangular	B 9808 0610
WS20x30	20 x 30	split-core	B 9808 0601
WS50x80	50 x 80	split-core	B 9808 0603
WS80x120	80 x 120	split-core	B 9808 0606

Other measuring current transformer types on request



### Flexible measuring current transformers (pulsed DC sensitive)

WF... series measuring current transformers consist of one flexible W...F series measuring current transformer and one RCC420 signal converter.

Type	Inside diameter/mm	Supply voltage	Art. No.
WF170-1	170	DC 9.6...94 V / AC 42...460 Hz 16...72 V	B 7808 0201
WF170-2	170	DC 70...300 V / AC 42...460 Hz 70...300 V	B 7808 0202
WF250-1	250	DC 9.6...94 V / AC 42...460 Hz 16...72 V	B 7808 0203
WF250-2	250	DC 70...300 V / AC 42...460 Hz 70...300 V	B 7808 0204
WF500-1	500	DC 9.6...94 V / AC 42...460 Hz 16...72 V	B 7808 0205
WF500-2	500	DC 70...300 V / AC 42...460 Hz 70...300 V	B 7808 0206
WF800-1	800	DC 9.6...94 V / AC 42...460 Hz 16...72 V	B 7808 0207
WF800-2	800	DC 70...300 V / AC 42...460 Hz 70...300 V	B 7808 0208

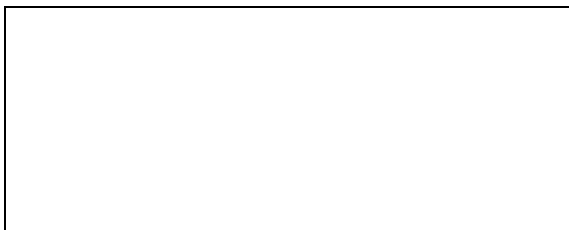
Type	Inside diameter/mm	Supply voltage	Art. No.
WF1200-1	1200	DC 9.6...94 V / AC 42...460 Hz 16...72 V	B 7808 0209
WF1200-2	1200	DC 70...300 V / AC 42...460 Hz 70...300 V	B 7808 0210

### Measuring current transformers accessories

Type	Art. No.
Snap-on mounting for W20.../W35...	B 9808 0501
Snap-on mounting for W60...	B 9808 0502

### Label for modified versions

There will only be a label in this field, if the device is different from the standard version.



# INDEX

## A

Alarm 33, 40  
Alarm status 33, 40, 69  
alternating currents 14

## B

Bar graph 32, 41  
Bender service 61  
Bus address 59

## C

Commissioning 29, 67  
Connection 19  
Connection example 25  
Control 62  
Cutoff frequency 54

## D

Data logger 57  
Date 60  
DC component 44  
Delay on release 53

## E

Error code 67, 68

## F

Factor (measuring current transformers) 51  
Factory settings 61

Fault memory 47  
Frequency response 14, 54  
Fuses 19

## H

Harmonic 14, 43  
High fault tolerance 15  
History memory 41  
How to use this manual 7  
Hysteresis 47

## I

Installation 19  
Intended use 14

## L

Language 59

## M

Main menu 36  
Maintenance 67  
Measuring current transformer type 55

## N

Nominal insulation voltage 19

## O

Offset 48, 49  
Operating mode 32

Ordering information 76

Overcurrent 53

Overview diagram 38

## **P**

Password 60

presetting 48

Prewarning 33, 47

Property protection 54

Protection against fire 54

pulsating currents 14

## **R**

r.m.s. value 33, 40

Rated frequency 43, 48

Relay mode 56

RESET 35

Response delay 53

## **S**

Service 8

Standard information 36, 65

Standards 67

Summertime 60

Support 8

Switching actions 48

Switching on 29, 30

## **T**

Test communication 62

Test function 67

Testing the device function 34

THF 43

Time 60

Training courses 10

Transformation ratio 51

Transformer monitoring 55

## **U**

Undercurrent 53

## **W**

Wiring diagram 22

Work activities on electrical installations 13

workshops 10









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